Device Characterization of Solar Inverters

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USING GALLIUM NITRIDE IN SOLAR INVERTERS

Motivations:

- Increase the efficiency of solar energy, known to be highly inefficient
- Decrease the overall cost
- Potentially more durable
- Website: making this information more useful in practice

Testing Needed:

- Static and dynamic characterization

My role in this:

- Assist with testing
- Technique for storing data

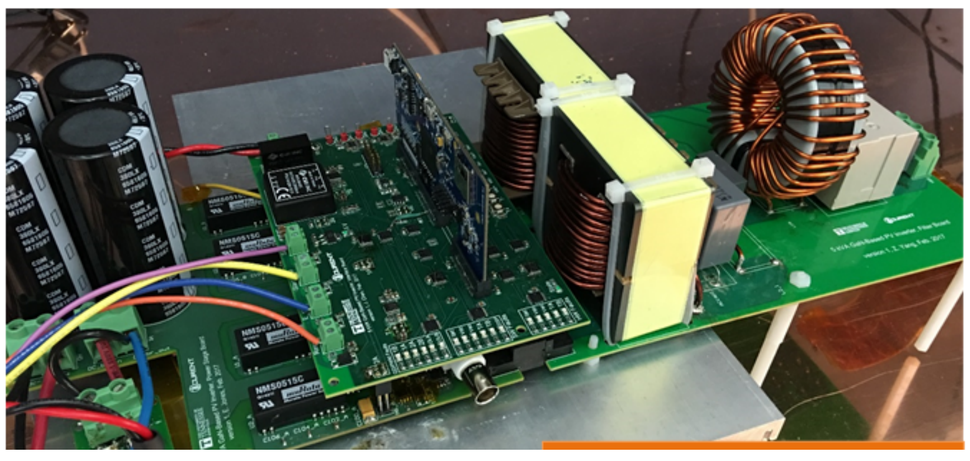
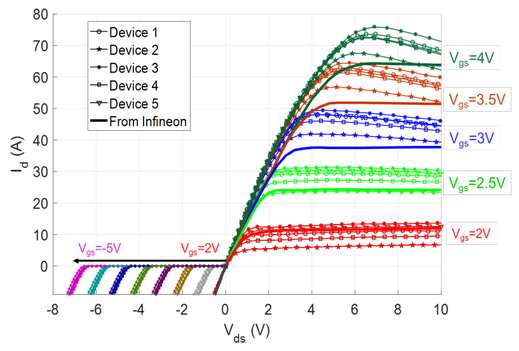


Figure 1 (above): Solar inverter
Figure 2 (right): Device used for testing

STATIC CHARACTERIZATION

Behavior while Fully On/ Fully Off:

- internal resistance of the devices
  - conduction loss
- How much voltage can the device withstand before failure?
- At any particular voltage, how much current can the device carry?
- Curve Tracer



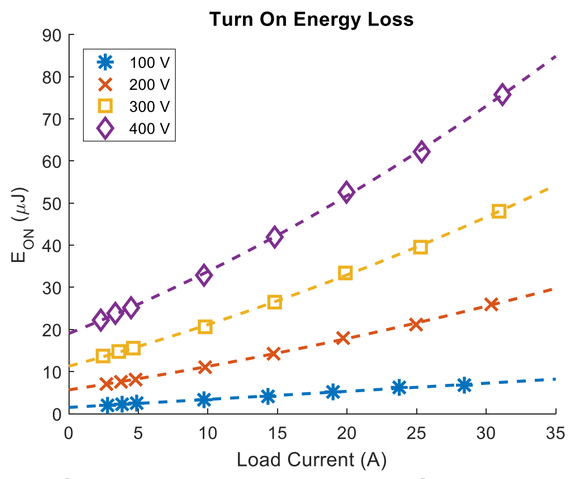
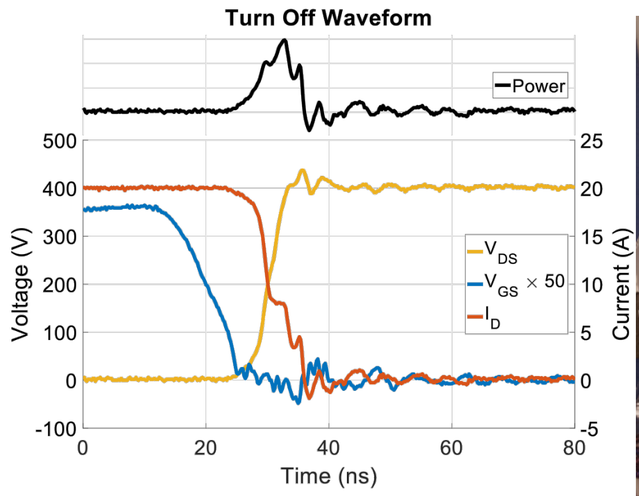


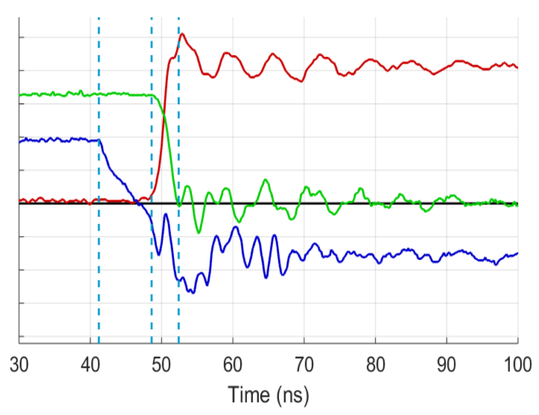
Figure 3 (left): a graph of the information received from the curve tracer
Figure 4 (right): graph of turn on energy losses

DYNAMIC CHARACTERIZATION

Behavior while Switching:

- Time during which voltage and current are changing as the device switches on and off.
- Power loss due to the overlap of voltage and current
- Oscillation present while switching: overshoot
  - Voltage going above the power rating during shut off





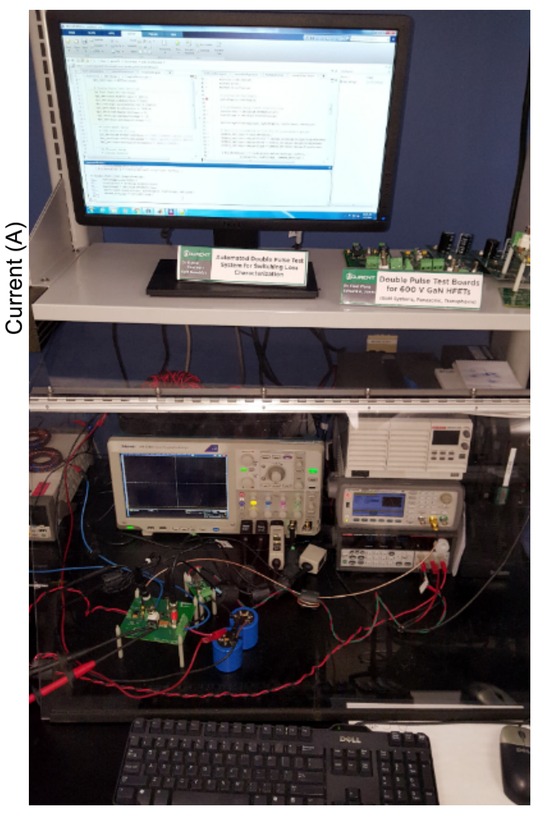


Figure 5 (left, top): Turn off waveform
Figure 6 (left, bottom): Example of oscillation while switching
Figure 7 (right): Dynamic Testing Set Up

STORING THE INFORMATION

Website

- Searching capability
- Uploading with progression
- Not repeating tests
- Widespread use

RESULTS SO FAR

- Overshoot
- Faster switching → Loss
- Internal Resistance
- Ground Work for Database

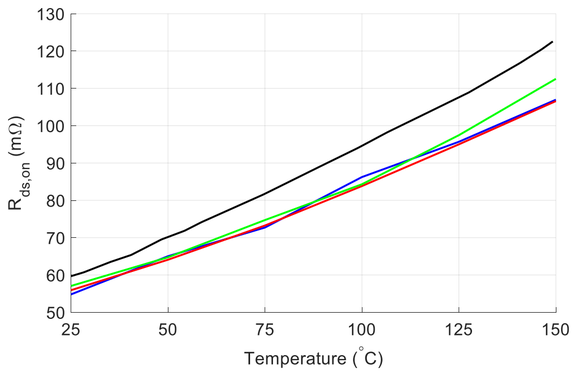


Figure 8: Graph of internal resistance

FUTURE RESEARCH

- Better database implementation
- Cost analysis
- GaN, Si, SiC comparisons

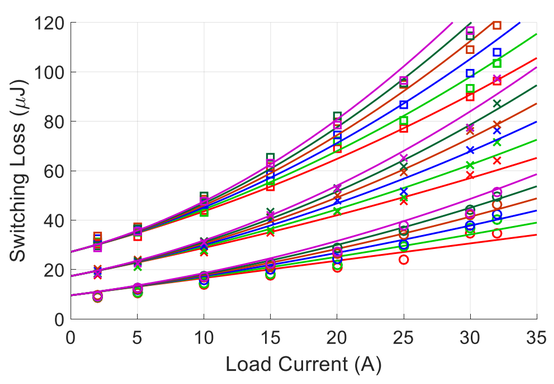


Figure 9: Switching loss